

Docket No.: 0071-Q593PUS1  
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:  
Akira MITSUI et al.

Application No.: 10/500,701

Confirmation No.: 2439

Filed: July 2, 2004

Art Unit: 1711

For: LOW MOLECULAR WEIGHT  
POLYPHENYLENE ETHER

Examiner: D. Truong

37 CFR § 1.132 DECLARATION

*"Declaration II"*

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450  
Sir:

I, Akira Mitsui, a Japanese citizen, residing at 3-16-2, Fukuodai, Sodegaura-shi, Chiba 299-0261 Japan, do declare as follows:

I am the joint inventor of US application No. 10/500,701, entitled "LOW MOLECULAR WEIGHT POLYPHENYLENE ETHER";

I am familiar with the invention of the above-identified application and the prosecution history of US application No. 10/500,701;

I have read and understand the official action mailed on April 3, 2006 against US application No. No. 10/500,701 and the references cited therein (*i.e.*, Braat US '327 (US 6,211,327), WO '273 (WO 00/46273) and Dalton et al. US '164 (US 4,463,164));

In order to show the patentability and non-obviousness of the instant inventive product by process claims 27-28, I declare as follows.

In the outstanding office action of April 3, 2006, the USPTO takes the position that no weight should be given to process parameters recited in product-by-product claims 27-28. In support of this contention, MPEP § 2113 is quoted. However, MPEP § 2113 also clearly states as follows:

*"[t]he structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product."* (emphasis added)

Accordingly, the following facts evidence that the process steps recited in product-by-process claims 27-28 would be expected (by those skilled in the art) to impart distinctive structural characteristics to the final produced product.

*Claim 27: Product-by-Process Claim -*

*Reciting Solution Method Step and Subsequent Selective Precipitation Step for Low Molecular Weight PPE within a Defined Temperature Range*

27. A low molecular weight polyphenylene ether which has a reduced viscosity ( $\eta_{sp}/c$ ), as measured at 30°C in a 0.5g/dl chloroform solution, of 0.04-0.18 dl/g, and a molecular weight distribution of 1.5-2.5, wherein

*said low molecular weight polyphenylene ether is obtained by a process, which comprises the steps of:*

*polymerizing a phenol compound in the presence of a catalyst and an oxygen-containing gas using a good solvent of said low molecular weight polyphenylene ether;*

*adding a poor solvent of said low molecular weight polyphenylene ether to the polyphenylene ether solution obtained by said polymerization; and*

*precipitating a low molecular weight polyphenylene ether at the temperature in the range of - 80 to 20°C. (emphasis added)*

As mentioned below, molecular weight distribution of the precipitated PPE (final product) depends on a temperature of the precipitating step (process). That is, the process of this claim affects the structure of the final product, and as such, process limitations should be given weight by the USPTO in considering the patentability of the pending claims.

*Process Step 1 (Solution Method Step)*

*"...polymerizing a phenol compound in the presence of a catalyst and an oxygen-containing gas using a good solvent of said low molecular weight polyphenylene ether..."*

At the end of this step, the obtained PPE is dissolved in a solvent (i.e., there is obtained a polyphenylene ether solution). The molecular weight of each PPE polymer chains obtained should be various, since the molecular weight is affected by the distribution of various conditions, such as temperature, concentration of catalyst or monomer, within a reactor.

Therefore, at the end of step 1, the molecular weight distribution of the dissolved PPE in solution would be expected by those skilled in the art to be relatively broad. This process step is a *solution method step*.

*Process Step 2 (Selective Precipitation Step)*

*"...adding a poor solvent of said low molecular weight polyphenylene ether to the polyphenylene ether solution obtained by said polymerization; and precipitating a low molecular weight polyphenylene ether at the temperature in the range of - 80 to 20 °C".*

The desired low molecular weight PPE is precipitated by adding a poor solvent for the low molecular weight PPE to the solution of the PPE in a good solvent for the low molecular weight PPE. The addition of the selective poor solvent to the low molecular weight PPE is thought to attack or hinders interaction between the low molecular weight PPE and the good solvent in which it is dissolved, thereby causing a selective precipitation of the low molecular weight PPE from the solution obtained in the process step 1 (*i.e.*, solvent method step).

When the precipitation in Process Step 2 is carried out at a higher temperature than that recited in claim 27 (*such as* 30 °C), almost all the obtained PPE in the solution of the good solvent should be precipitated. Therefore, the molecular weight distribution of the precipitated PPE would be expected to be almost the same with that of the PPE dissolved in the good solvent (*i.e.*, being relatively broad). However, by adding the selective poor solvent and precipitating at a defined temperature range as recited in pending claim 27, the low molecular weight PPE is

selectively precipitated out of the solution containing the good solvent (and addition of a poor solvent for the low molecular weight PPE).

Accordingly, as the molecular weight distribution of precipitated PPE (final product) is depends on a temperature of precipitating step in claim 27 (Process Step 2). it follows that the process steps set forth in product-by-process claim 27 "affect the structure of the final product" and Therefore, claim 27 should be allowed.

*Claim 28: Product-by-Process Claim ~*

*Precipitation of PPE in the Course of Polymerization, Wherein the Polymerization Solvent is a Mixture of at Least Two Alcohols.*

28. *A low molecular weight polyphenylene ether which has a reduced viscosity ( $\eta_{sp}/c$ ), as measured at 30°C in a 0.5g/dl chloroform solution, of 0.04-0.18 dl/g, and a molecular weight distribution of 1.5-2.5, wherein said low molecular weight polyphenylene ether is obtained by a process, which comprises the steps of:*

*polymerizing a phenol compound in the presence of polymerization solvent, a catalyst and an oxygen-containing gas; and*

*precipitating said low molecular weight polyphenylene ether in the course of the polymerization,*

*wherein the polymerization solvent is a mixture of at least two alcohols.*

*(emphasis added)*

In product-by-process claim 28, during the course of polymerization, a PPE is precipitated when the molecular weight grows to that a polymer that cannot be dissolved in the polymerization solvent. The molecular weight of the precipitating PPE depends on a kind of

solvent. The specific range of molecular weight distribution of PPE (final product) can be obtained by using a mixture of at least two alcohols as a solvent (process). As a result it follows that the final product obtained is dependent on the specific process steps set forth and particularly the following process steps inasmuch as they clearly are able to affect the structure (e.g., molecular weight) of the final product:

*"...polymerizing a phenol compound in the presence of polymerization solvent, a catalyst and an oxygen-containing gas; and  
precipitating said low molecular weight polyphenylene ether in the course of the polymerization,  
wherein the polymerization solvent is a mixture of at least two alcohols."*

As indicated above, the MPEP at § 2113 clearly sets forth that:

*"[t]he structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product."* (emphasis added)

Those skilled in the art would realize and expect that the process steps recited in pending product-by-process claims 27-28 impart distinctive structural characteristics to the final product, as is also described above. For such reasons, it is improper for the process limitations of product-by-process claims 27-28 to be ignored by the USPTO during prosecution of the instant application and claims.

In support of the above conclusion, the USPTO's attention is also directed to "Declaration I" filed on even date herewith in the matter of the instant application that contains comparative testing data therein, including that set forth in Exhibit Figures 1-3, which clearly shows that the PPE of the instant invention has unexpected and advantageous properties not possessed by the compositions of the cited art in the office action of April 3, 2006 (*i.e.*, Braat US '327 (US 6,211,327), WO '273 (WO 00/46273) or Dalton et al. US '164 (US 4,463,164)).

Such comparative testing results in "Declaration I" are submitted to further evidence that PPE produced using the process steps recited in product-by-process claims 27-28 "would be expected to impart distinctive structural characteristics to the final product."

*Exhibit Figures 1-3 from "Declaration I" filed on even date herewith in the matter of the instant application are incorporated herein by reference in their entirety.*

The undersigned declarant declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 24 day of September 2006.

Akira Mitsui  
Akira Mitsui